DOCUMENT RESUME

ED 192 553 FL 011 586

AUTHOR Carpay, Jacques
TITLE Cognitive Mastery of Grammar Rules in Foreign Language Learning. Some Experimental Work Based on the Vygotskian Model.
PUB DATE 80
NOTE 63p.; Paper presented at the Annual Meeting of the American Educational Research Association (Boston, MA, 1980).

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Audiovisual Instruction; Cognitive Processes; Dutch; *Grammar; Interference (Language); Language Patterns; *Language Processing; Language Research; Learning Activities; Models; Psycholinguistics; *Russian; *Second Language Learning; Socialization; Symbolic Learning; Transfer of Training
IDENTIFIERS *Vygotsky (Lev S)

ABSTRACT

The research discussed here, primarily that of P.J. Gal'perin and his associates at the University of Moscow, is an experimental demonstration of basic tenets of Vygotsky's theory. According to Gal'perin, grammatical knowledge is formed first by teaching the students material grammatical actions; these actions are ultimately to become mental actions. These mental actions are developed by passing through a series of stages in which the action takes successively different shapes, that is, material, verbal, and mental shapes. The teaching strategies developed by Gal'perin are discussed in some detail. Further discussion is devoted to a series of experiments in which use is made of: (1) visual models which materialize the grammatical structure underlying the concept of verb aspect in Russian, and (2) an activity algorithm which serves as a recipe for the performance of the given task. (Author/AMH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED192553

Cognitive Mastery of Grammar Rules in Foreign Language Learning. Some Experimental Work Based on the Vygotskian Model.

Jacques Carpay
Department of Education
Free University
Amsterdam, The Netherlands

Paper presented at the Annual Meeting of the A.E.R.A., Boston, 1980.

FL011586

1. Introductory remarks

The aim of this presentation is to give a brief outline of some research in the field of foreign language teaching and learning based on principles derived from a single, very comprehensive theory, the cultural-historical theory of higher mental functions pioneered by Lev Semënovič Vygotsky in the 1920s and 1930s (cf. Wertsch, 1979, Vygotksy, 1978).

The research discussed here, primarily that of the educational psychologist P.J. Gal'perin (University of Moscow) and his associates, is an experimental demonstration of basic tenets of Vygotsky's theory. This new kind of educational-psychological research began to take shape in the USSR around 1960 (cf. Cole and Maltzman, 1969).
In keeping with the dictum that one must test theory in practice, this research uses the classroom and the activities of the classroom to carry out the scientific analysis of foreign language learning and teaching. This analysis is based on two aspects of Vygotsky's theoretical framework. First, it reflects his emphasis on genetic explanation of psychological phenomena. Second, it reflects his concern for the role that social interaction plays in the development

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Jacques Carpay

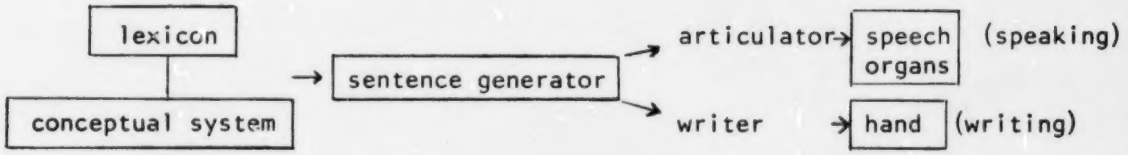
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

of all higher mental functions, which according to Vygotsky, appear first on the 'interpsychological' (i.e., social) plane and only later on the 'intrapsychological' (i.e., individual) plane. Thus, the transition from interpsychological to intrapsychological functioning is the main cornerstone of the approach (cf. Wertsch, ibidem). Theoretically, the thinking presented in this paper is clearly in tune with current ideas about the development of metalinguistic and metacognitive skills prominent in Western psycholinguistic and psychological circles.
First of all I should like to discuss Gal'perin's work on the meaningful learning of grammatical features and patterns in a foreign language at school. I shall begin with his analysis of the learning task; then, I shall discuss in some detail the teaching strategies he has developed; finally, I shall outline the results of a series of experiments recently completed in schools in The Netherlands, including pupil-participants' response to their learning experience.

2. Analysis of the learning task

Pjotr Jakolevič Gal'perin has devoted several articles to the psychological basis of foreign language learning in schools. The earliest publication I have been able to find dates from 1967; the most recent appeared in 1977. In addition to these publications his theory has been applied and developed in a number of doctoral dissertations written under his direction, notably Gochlerner (1972), Gol'din (1970), Kabanova (1971) and Kučerova (1970).
Limiting myself to language production, i.e. speaking and writing, I shall make use of a model of the human language user developed by the Dutch psycholinguist Kempen (1976) as a means of quick access to Gal'perin's theory.

Fig. 1. The human language user (Kempen, 1976)



The "sentence generator" component will take us unto Gal'perin. Two key processes take place in this component: 1. the semantic content of the intended utterance is specified (the process of conceptualization) and 2. this conceptual content is formulated, that is to say, words are sought in the lexicon which are suited to convey the intended message and the words are arranged into a sentence (the process of formulation, including the processes of lexicalization and syntacticalyzation).

Whether these last two mechanisms are connected in series or parallel, or partly in series and partly parallel, will remain a moot point here. Those wishing a further discussion of this issue are referred to Kempen (1976) or Leont'iev (1971).

The processes which take place in the "conceptualizer" and in the "formulator" proceed as it were automatically in the native language. In using everyday language, in particular, we are virtually unaware of the psychological activity involved in matching available words and constructions to intended messages. Nor do we stop to consider the fact that what we have to say and the means at our disposal to say it in our native language are so marvelously attuned to one another. We do not as a rule become aware of this until we come into contact with other languages, or until we become acquainted with scientific thought and fact. Consider, for example, the contradiction between language and fact in expressions like "The sun rises ... and sets" (which of course it doesn't), or even a word like woodchuck (an animal, I'm

told, which does not chuck wood, or indeed have anything to do with wood).

A few simple examples will illustrate this further. A speaker of English may say "That's my car" when speaking of a possession, but also "That's my bus" when speaking of a vehicle he clearly does not possess, but is merely going to make use of. Many European languages, including Dutch, French, German and the Slavic languages, make use of the same "conceptualization" for both speaker-object relationships, and of the same linguistic means, the possessive adjective, to express them. No one stops to think that the relationships are not the same. But there are languages (e.g. Turkish) in which the speaker-bus relationship is expressed differently from the speaker-car relationship, in which, for example, one may say my car, but not my bus. The latter would be expressed by means of a construction whose conceptual content might be rendered as "the bus for my benefit". The distinctiveness of the message in this case is based on a different organization of reality than obtains in our native languages.

Of course we needn't resort to exotic languages for similar conceptual differences. The English speaker would say "the letter is in the envelope". For the speaker of Dutch, the letter sits in the envelope, and for the speaker of Russian, it lies there. The Dutch speaker says "We were with seven people" to mean a total of seven people were present. To the English speaker this expression would mean at least 9 people were present. One could say the Dutch with includes, whereas the English with coordinates or attaches, at least in this case. One's native language invariably seems to reflect reality "best", but who is to judge? And does it really matter? With Gal'perin, I simply ascertain that learning a foreign language by and large requires the learner to become aware of the thought contents, the conceptualizations which in Gal'perin's terms constitute the "linguistic consciousness" of the Englishman, American, Dutchman, Frenchman, et cetera. To return to the example of the letter in the

envelope, we see that the foreign learner of one of these languages would have to become familiar with the system, in this case the semantic system which underlies the constructions (here verbs) which refer to the conditions objects may be in. An English speaking learner of Dutch, for example, would have to divide his concept of "rest", generally associated for him with the verb be, into three different categories having to do with the shape or position of the resting object: for a Dutchman, a cork sits on a bottle, a handkerchief sits in someone's pocket, but a broom stands in a closet, a bottle stands on a shelf, and a comb would lie in a drawer, money lies in a bank, and a ship lies in port. A Russian speaker deals with this segment of the material world differently again.

Gal'perin calls the systematic explicitation of these and other comparable thought contents in the native language as a basis for later expression in foreign language communication "pereososnanaye", which, for lack of a single perfectly equivalent term in English (there is none in Dutch either) I shall render as "reconceptualization of the native language". Gal'perin distinguishes between, on the one hand, knowledge of and thought about the material and mental world (which he calls cognitive consciousness) and on the other hand the thought content which is reflected in language (linguistic consciousness in Gal'perin's terminology). This distinction gives rise to the question of its implications for foreign language instruction. Gal'perin deals with these in his latest publication (1977):

1. The semantic basis of all lexical and grammatical categories of the foreign language must be determined. Although this is no simple task, it is not, according to Gal'perin, impossible to map out the most important conceptual systems. Once we have determined the semantic basis of, for example, cases in Russian, or verb tenses in English, we have at our disposal an analytic tool which can provide a learner with the criteria he needs to analyze (his own) speech intentions in order to choose the correct form in the foreign language. The foreign language learner is made to see his

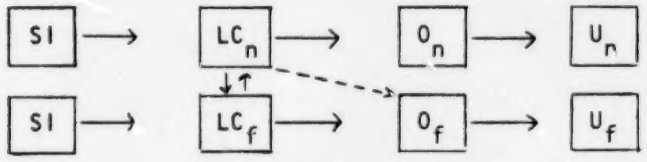
speech intentions through Russian or English eyes, or, so to speak, through Russian or English-colored glasses. To put it in terms of applied linguistics, we may say that Gal'perin advocates contrastive analyses of thought acts and not exclusively of observed language utterances.

2. The learning process must not be started with imitation or application of foreign language operations on speech intentions which have been highly pre-structured by the teacher or the textbook. When dealing with semantic problems, which are the most difficult, Gal'perin advocates starting in the native language. In terms of Kempen's model, we may say that Gal'perin first focuses on the process of conceptualization before proceeding to the process of formulation. He first has his pupils analyze Russian sentences, for example on the basis of the criteria which determine tense choice in English. Only after his pupils have mastered these criteria does he introduce material in English. The pupils do not translate in the first phase, they merely indicate whether form A of B is required, motivating their choice as well. One clear advantage of this strategy is that there is no need to restrict the material to words the pupils have had. Innumerable speech intentions can be analyzed, and pupils themselves may contribute examples. In Davydov's terms (1977) we may say that the first step aims at bringing about "theoretical generalization". The study material is organized from the general to the specific. Therefore two types of learning activity are necessary: (1) learning activities to reveal the most general, genetically primary relationships in particular (specific) material; and (2) learning activities to give concreteness and specificity to the general relationships discovered previously.
Using these two kinds of learning activity, pupils assimilate the system of concepts in the course of study and, secondarily, the semantic make-up of the various kinds of speech intentions, that define and exemplify the area of application of a certain grammatical rule.

A concrete example of experimental instruction based on the theoretical framework discussed so far will be presented in section 5.

3. Given a systematic, insight-based differentiation between the native and the foreign language consciousness, the much-feared phenomenon of interference will simply not occur. (See Fig. 2.) Gal'perin aims at making an ally rather than an enemy of the native language. In his view, this is possible only if learners are first made explicitly aware of their native language consciousness. In Gal'perin's view, learners fail to master foreign languages primarily because little or no attention is paid to systematic semantic analysis in school native language courses. And if any attention is paid to semantic contrastive analysis in foreign language courses, it is by no means sufficiently systematic.

Fig. 2. Schematic representation of Gal'perin's theory



SI speech intention
LC linguistic consciousness; n native language
f foreign language
O operation(s)
U utterance
------> interference

This completes my of necessity condensed exposition of Gal'perin's analysis of the learning task. In the next two sections I should like to outline some of the characteristic features of his teaching strategies. It is important to keep in mind that Gal'perin and his

associates always experiment in schoolclasses and that a schoolteacher rather than an outsider functions as experimenter.

3. The conceptual framework of Gal'perin's teaching-learning theory

In addition to his theory on interference, Gal'perin has also developed a teaching-learning theory which mainly integrates meaningful learning integrated into activity. A brief exposition of this by Gal'perin in English translation can be found in the 'Handbook of Contemporary Soviet Psychology' (Cole and Maltzman, 1969). Further reference can be made to a recent publication by Markova (Markova, 1978-79). According to Gal'perin, grammatical knowledge is formed first by teaching the students material grammatical actions, which are ultimately to become mental actions. These mental actions are developed by passing through a series of stages in which the action takes successively different shapes (i.e. material, verbal, mental). Furthermore, at each stage of the learning process, the student is provided with a complete orienting basis, i.e. all the directions needed to perform a given task. Such a complete orienting basis ensures insight-based performance.

4. Characteristic features of the experimental teaching-learning materials

The development of such an orienting basis presupposes a thorough understanding of the learning activity. One factor of basic importance in understanding a learning activity is the analysis of external and internal aspects of the performance of an activity, especially the role of symbolic (mental) representations of the suject matter (cf. Jean Piaget and Jerome Bruner) and the process of internalization (cf. Vygotsky, A.N. Leont'iev, Gal'perin). The complete orienting basis for the three-stage learning process also necessitates the use of external supports (cf. Vygotsky, 1978) two types of which can be distinguished according to Markova (1978-79, pp. 100 ff.): concrete representation of the structure of the object being studied, and

concrete representation of the structure of the activity. These notions will be illustrated in section 5 when I discuss an experiment done by myself (Carpay, 1974) and 'authorized' afterwards by Gal'perin.

"Materialization" is, then, the first distinctive feature of Gal'perin's teaching strategy. As in other areas, and I might add, in contrast to the usual classroom procedures in the Soviet Union, Gal'perin makes memorization unnecessary. Pupils are given a scientifically based, reliable "cheat sheet" to consult. Rejecting the assumption that "if you've had it, you must know it", Gal'perin's procedure organizes and sequences the exercises in such a way that pupils ultimately have no need to refer to these "cheat sheets", or in Gal'perin's terms "learning cards".

Gal'perin's procedure is also characterized by the way the division of labor is organized. Usually, one pupil does the work and the other checks it. Each pupil takes his turn in performing all the functions of a collective activity.

In the classroom Gal'perin makes use of three consecutive learning activities. Each new topic is first introduced by the teacher to the whole class. Then the pupils work on assignments, in pairs or groups of 3 or 4. In this phase pupils alternate taking the role of teacher-monitor and of learner. One aim of this activity is to create a natural setting in which pupils must verbalize their thinking aloud. The assignments may consist of analyzing sentences set by the teacher and formulating sentences which meet certain requirements. The third phase of the procedure involves working alone. Note that in the three-step procedure, the teacher's role shifts systematically to the individual pupil.
The procedure is an operationalization of the aspect mentioned in section one: the transition from the social to the individual plane, from external control to selfcontrol.

In introducing new material, Gal'perin and his students usually work with an 'instruction', such as is commonly used in psychological 'laboratory' experiments. That is to say the teacher-experimenter demonstrates or explains what must be done and why. I would advocate, however, as would Davydov and Markova (see Markova, ibidem) guided discovery through discussion for this phase. Eliciting examples from his pupils and supplementing these with his own where needed, the teacher constructs together with his pupils the "learning card" (cheat sheet) they will later use. I believe that this technique is pedagogically preferable to the one-way 'expository' lesson-format, especially as it provides more and better opportunities for feedback, and for response to the needs of individual learners.

I believe that Gal'perin's teaching strategy offers a number of possibilities for individualization and differentiation in the classroom, in terms of tempo, task and role. Pupils can work more quickly or more slowly as needed, can take the role of teacher or learner in pairs or small groups more or less frequently as needed, can be given more abstract or more concrete tasks to perform, and so on.
And it goes without saying that this approach is eminently suited for further experimentation in the school classroom.

5. The aspect experiment

From 1970 to 1976 I carried out a series of experiments in which I applied Gal'perin's theory to the teaching of semantic criteria for choosing the correct aspect form of the Russian verb. In this research in which Dutch speaking first year university students and 9th graders from both college preparatory and commercial streams participated as subjects, I tested several variations of "learning cards" and classroom (experimental) procedures.
In the research use was made of similar work done by Russian as well as Western psycholinguists and psychologists. For further reference in

this respect I refer to a publication of my own (see Carpay, 1974). In my research I used

1. visual models which materialize the grammatical structure, and
2. an activity-algorithm which serves as a recipe for the performance of the given task.

3.1. Main characteristics of the experimental 'mini-course'

My research covers a topic which is both important and difficult: the selection of the appropiate verb aspect in Russian. The main characteristics of the experimental 'mini-course' are the following:

a. In contrast to the usual procedure, in which pictures are captioned in the foreign language (cf. Vjatjutnev, 1972) we introduced these aspects by means of pictures with Dutch captions. The decision for this deviating approach was taken on practical as well as theoretical grounds. The practical advantage of operating with Dutch captions is obvious in that it is independent of the student's knowledge of particular Russian verbs. One could even work with subjects who do not know Russian at all.
   The decision to use Dutch for teaching the subjects the concepts of aspect may also be justified theoretically on the basis of the psychology of language, learning and thinking. The concepts to be formed are absent as a grammatical category in the native language. In order to operationalize "aspect" one must, therefore, make the student conscious of the conceptual schemes used by speakers of Russian in the selection of a certain verb form. Considering the fact that the explication of the characteristics and features of conceptual schemes used by Russians requires a metalanguage, the option in this case was for native language 'labels'. Moreover, this choice is supported by Gal'perin himself who, as was discussed in section 2, advocates that the orienting basis be built on the native language.
b. In teaching the choice of aspect (imperfective/perfective) for finite forms in Dutch sentences, a number of visual models were developed. In addition, an activity-algorithm was developed to

teach the use of these models. This algorithm is nothing but a "recipe" of the complex action that must be learned. The idea of combining visual models with an activity-algorithm was taken by Gochlerner (cf. Van Parreren, 1975).

c. In order to optimize the use of the activity-algorithm and the visual models, they were integrated. The subject thus does not need to manipulate two aids simultaneously, as was the case for Gochlerner, for example. As our experiment uses seven models in total, ergonomic reasons alone would favor the procedure selected.

d. The subjects internalize the models by acting upon them. The algorithm does not have to be memorized but functions exclusively as an external support ("cheat sheet") in the first stages of the learning process. Its function may be compared to that of the instructions for use that come with a new tool and become superfluous after the actions involved have been performed a number of times.

e. Algorithm and models do not remain unchanged throughout the entire teaching-learning process. When the subjects have become familiar with the comprehensive version of the aid, it is replaced by a condensed version. In this way, an attempt is made to guide the learner into a shortened, reduced version of the action. The desirability of such guidance is supported by research, particularly that conducted by Kuljutkin and Suchobskaja (1967). This research clearly reveals that subjects who have to apply algorithms (want to) skip 'steps' in the learning process at a certain moment (see also Resnick, 1976). We felt that this transformation of the activity structure should occur under optimal control.

f. In order to control the variable of 'teacher', a form of programmed instruction was used. Each subject has a 'learning package' containing all necessary information and aids (see 5.4.).

g. In order to organize the necessary verbalizations (speaking aloud) optimally, the experimental course contains 'steps', some of which must be taken individually, others in pairs.

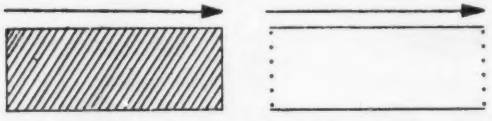
h. Partner selection is free in our course. The subjects can choose a partner who has, at that particular moment, also attained a certain level or they can choose a partner with whom they like to work toghether. In the latter case, they may have to wait until this person is ready.

i. The total experiment lasts three hours at the most. But the program is divided into two sessions of 1.5 hours each. There is a test at the end of the second session. Subjects are asked not to talk to each other about the experiment in between the two session, which take place on two consecutive days. This measure is taken to keep the course of the learning process as pure as possible.

j. Although the program is 'teacher-free', the students of course have the right to communicate with the experimenter since there is no such a thing as 100% accuracy in choosing aspect. If at any point in the program the students choose an aspect which is different from the one given in the 'key', they can discuss their solution with the experimenter.

5.2. Visual models

The following visual models were developed for orienting the subjects into the deeper, underlying features that in fact account for the choice of the aspect forms in the past tense. In Dutch, the simple, i.e. inflected, form of the past would or could be used in all of the cases cited.*)
Two basic models, the perfective and the imperfective aspect respectively, form the starting point (cf. models I and II).



Model I *Model II*

In these models

(i) Rectangulars represent the event;

(ii) The arrows above the block represent the time axis;

(iii) Model I represents the perfective aspect, where the beginning

*) This experiment was limited to the choice of aspect in the past tense. Choosing aspect in the future tense can by and large be considered an analogous activity as it is 'mirrored'.

and the end of the event are clearly indicated. (Vertical lines on either end, represent the criterion: "The event reaches its natural end");

(iv) Model II represents the imperfective aspect, where the beginning and the end of the event are not clearly indicated. (Dotted vertical lines, represent the irrelevance or uncertainty of the event's reaching its natural end)

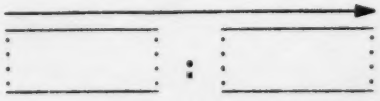
Moreover model I is filled, model II is not: this symbolizes once more the perfective versus the imperfective aspect.

Although these models contain all the features necessary to a motivated selection of the perfective or imperfective aspect we felt a need for a number of additional models (see models III through VII) which include the different semantic features determining the choice of aspect in certain concrete uses.

Model III

This model represents events classified as 'short indivisible moment'. This category of past aspect use refers to such events (sentences) as Er klonk een schot (a shot rang out) or Hij gaf haar een kus (he gave her a kiss). Model III is meant specially to teach the students how to differentiate between, for example, Hij at een meloen (he ate a melon), a durative action which ends and Hij gaf haar een klap (he struck her a blow), an instantaneous action.

In order to equip the students for sentences with more than one verb models IV to VII were developed.



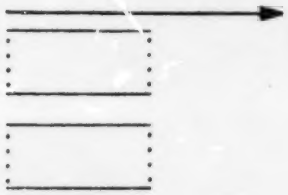
Model IV

Model IV symbolizes: 'repeated action' (cf. Vroeger ging Olga altijd 's zondags naar de kerk: Olga used to go to church on Sunday).

Model V

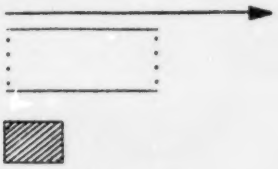
Model V represents 'successive actions' (cf. Hij dronk zijn glas leeg en vertrok: He emptied his glass and left (He drank his glass empty and left). The natural ending of the first action (dronk, drank) is indicated by the beginning of the second (third, etc.) activity.

Models VI and VII were developed to represent 'simultanity' of two or more actions.



Model VI

Model VI represents sentences such as Iwanov keek toe, hoe Smirnov werkte (Iwanov was watching Smirnov work). This model then, depicts 'totally simultaneous' actions which are both indicated in Russian by the imperfective aspect.
Model VII is used for the category 'partial simultaneity'.



Model VII

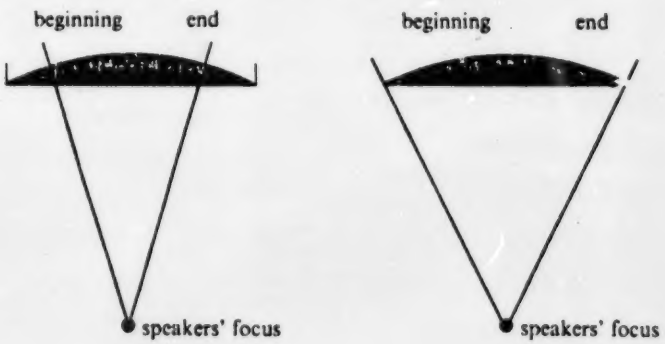
This model represents sentences such as Toen Olga binnen kwam, zat Pjotr de Pravda te lezen (When Olga entered, Pjotr was reading Pravda). Special for this category is that one action finds its natural end (= a telic or terminative event) and requires the perfective aspect (binnenkwam, entered), while the other is not limited in time (= an

atelic event) and requires the imperfective aspect (lezen, reading). Those familiar with the Russian language will have noticed that our system of 'aspect rules' is not entirely complete. It seems to us, however, that the categories of language use which are not covered by our rules (models) can easily be learned as 'special cases' after the students have internalized the basic rules. Our rules, then, may be considered 'advance organizers' (from Ausubel, 1963), that is to say as anchor points to which newly acquired information can be related.

5.3. The activity-algorithm

Model I through VII represent the separate, elementary operations (cf. Landa, 1969) involved in determining aspect. It is now necessary to represent the activity of 'choosing aspect' in one operational model. The first step of our activity-algorithm (see Figure 4) requires the student to imagine the event as the native speaker would (cf. Isačenko, 1962). He is aided in doing this by the visual models in Fig. 3. He then works through the "flow chart" until his choice of aspect is determined.

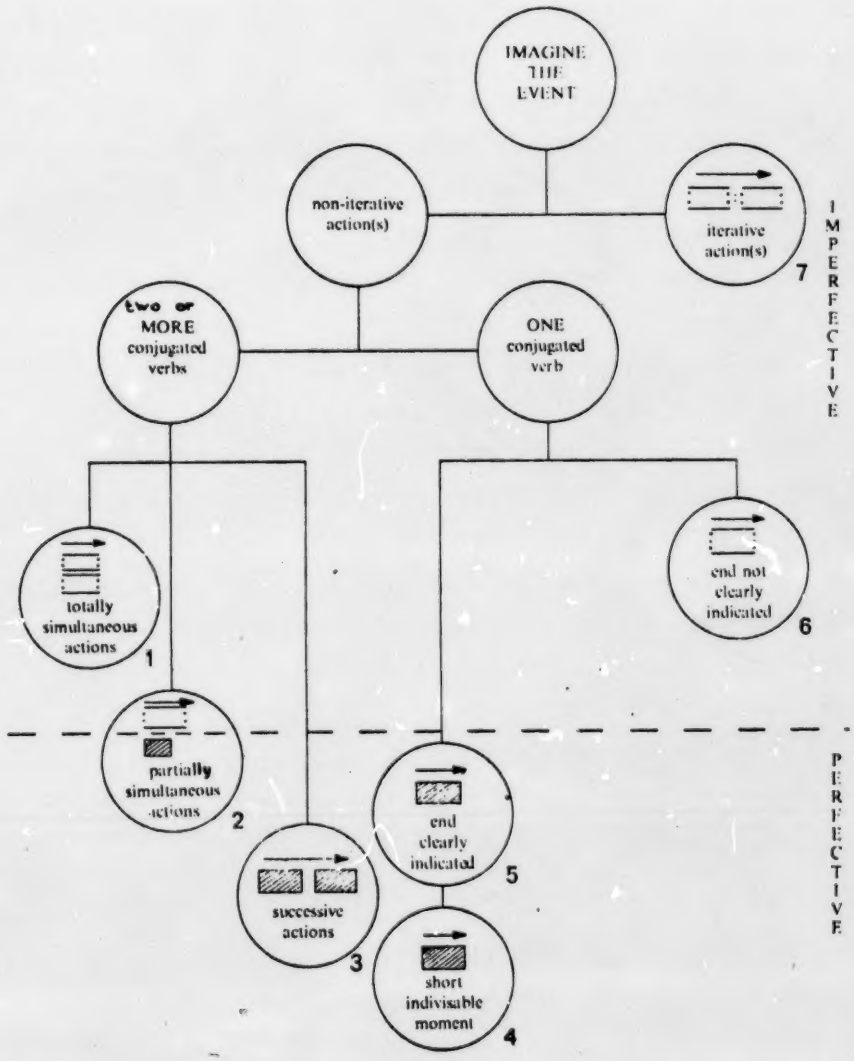
Fig. 3: Speakers' focus in choosing aspect



picture I *picture II*

A number of observations can be made about the "tree" (Fig. 4), which is the fourth and for the time being last variant in this research. The "tree" branches the determination of an iterative versus a non-

Figure 4: ACTIVITY-ALGORITHM I



iterative action higher than that of one or more than one conjugated verb in the sentence. In earlier versions of the algorithm, the reverse was the case. The present design was selected because subjects frequently did not recognize 'repetition' as a sufficient determinant of the imperfective aspect. *) The models for the feature of 'simultaneity' are on the left side of the tree. The model for 'partial simultaneity' lies partly in the imperfective field and partly in the perfective. Thus the experimental subjects are made conscious of the special position of this model, in which one verb requires the perfective and one the imperfective aspect. The model for the category 'short indivisible moment' was placed directly below the basic model of the category 'end clearly indicated' (perf. aspect) in order to help the subjects see that it is a special case of a basic model.
In avoiding any kind of maze in the design of the activity-algorithm we anticipate from the very beginning the 'abbreviation' of the action which must take place at a later stage of the learning process. The 'steps' are ordered and vizualized in such a way that the algorithm can, as it were, be telescoped. One drawback, however, could not be remedied. The necessay subdivision of the algorithm into two fields, for perfective and imperfective aspect, respectively, places the model for 'successive actions' at too large a distance from its (visual) antipole, the model for 'iterative action(s)'.

After the subjects have become familiar with the foregoing aids, the algorithm is replaced by a second one, in which the verbal labels for the different model have been removed. In order to enable our subjects to consult both versions of the activity-algorithm, as desired, we constructed a special aid. We drew tree 1 on a shee of paper, removing the upper half of each circle segment. Tree 2 is drawn on a sheet of paper attached to the back of tree 1 (see Figure 5).

*) N.B. We use only sentences with 'indefinite' frequency (signal words: always, in the past, every summer etc.). Sentences with 'definite' frequency (cf. twice etc.) do not (yet) occur in our 'mini-course'.

Fig. 5: Two parts from tree 1 and 2. The upper circle segment has been cut out.

Thus, subjects using tree 2 may overlay it wiht tree 1 at any time they feel the need of the verbal label in addition to the visual representation. Subjects easily switch trees. Very soon, however, they have no further need of tree 1.

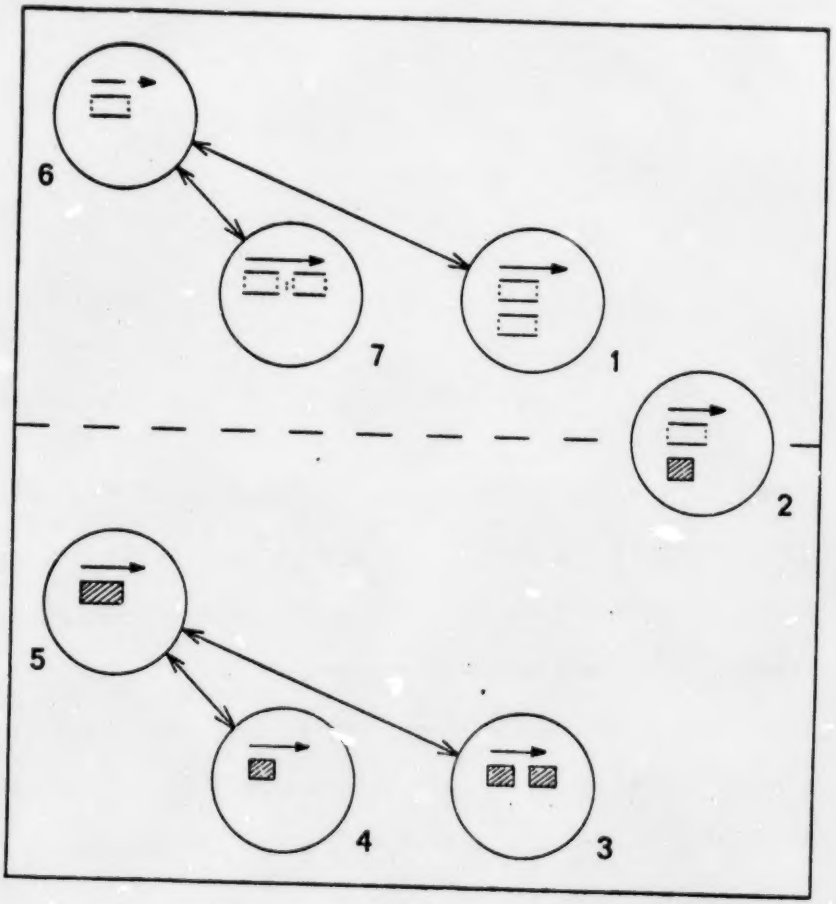
The subjects having exercised sufficiently with trees 1 and 2, the third tree is introduced in the second session. In this algorithm, there are no verbal labels and the perceptive field is organized differently. The function of tree 3 is to assist the subjects in reducing the number of categories from seven to three, namely,

(a) $P_1 \ldots\ldots\ldots\ldots P_n$ (all verbs perfective)

(b) $I_1 \ldots\ldots\ldots\ldots I_n$ (all verbs imperfective)

(c) P/I (one perfective, the other imperfective)

Fig. 6: ACTIVITY-ALGORITHM 3



5.4. Teaching-learning materials

The subjects are given a set of materials, consisting of the activity-algorithms discussed above and a number of booklets containing instructions and guide questions, explanatory text and matching pictures. The 'mini-cours' is subdivided into the following steps.

Step 1

A short explanation of the concepts of perfective (P) and of imperfective aspect (I). Emphasis is placed on the fact that aspect (Latin: aspicere = look) is a way of looking at an event (cf. figure 3). The subjects are also told that a speaker of Russian is, to a certain extent, free in his choice of aspect, but that by and large his choice reflects his psychological viewpoint.

Step 2

The experimental subject is shown a picture with a matching sentence. Zij speelden een harde wedstrijd tegen Ajax (They played a rough match against Ajax).
Then he is asked:

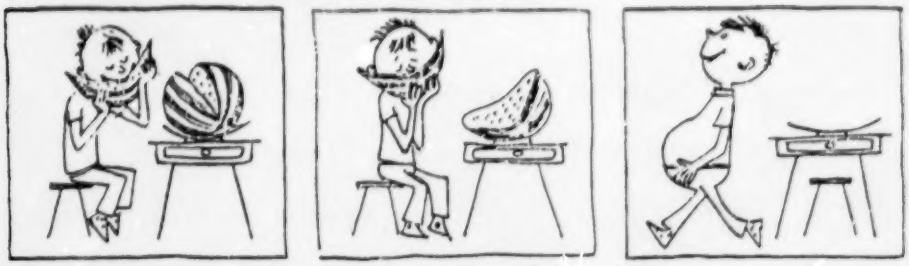
- which aspect do you think can be used here;
  perfective or imperfective?
- why?

When the subject turns the sheet, he sees the most likely solution. The first model is then immediately presented and explained. For the next six sentences, he is asked each time:

- which aspect - which model (of those presented so far) - why?

The first five sentences and matching pictures are examples of the perfective aspect, the last two of the imperfective. For the sentence: Pjotr at een meloen (Peter ate a melon) (Perfective) the following

picture series is used (Vjatjutnev, 1972).



Step 3

In this step, an number of models are expanded by means of pictures with matching sentences. Included are 'iterative action(s) (model 7) and 'short indivisible moment' (model 4). The model of 'clear ending' and 'ending not clearly indicated' (5 and 6) are further practiced.

Step 4

This step introduces the models for more than one conjugated verb (model 1, 2 and 3). As in steps 2 and 3, the subject is given carefully selected sentences and pictures. He is asked to consider the aspect and to point out the matching model which are presented in multiple choice form.

Step 5

In step 5, algorithm I is introduced in two parts. By means of familiar key sentences, the right side of the tree is practised first, then the left. (The subjects must name each step and find the 'best' solution on the back of each sheet.)

Step 6

From now on, pictures are no longer used but new sentences are introduced. The subject is asked 'to imagine a situation' (i.e. 'to form a speech intention'; cf. section 2) for each sentence. In this step the subjects operate in pairs, taking turns as 'student' and 'monitor'.

Step 7

Algorithm 2 is introduced in this step. The subjects work in pairs and are asked to point out the models which match the sentences without naming the labels. The first session ends with step 7.

Step 8

Sentences from steps six and seven are used. The subjects work in pairs. The 'student' must now draw the models involved; the 'monitor' supervises this activity.

Step 9

Algorithm 3 is introduced and practised. The decisions are now made in a different order: (1) perfective/imperfective aspect (2) model (3) verbal labels.

Step 10, 11 and 12

In these steps, subjects practice using algorithm 3, but now in pairs again. Step 12 is followed by the test.

The test

After step 12, the subjects are given a booklet with a test sentence on each page. The test contains a total of 18 new, Dutch sentences. At least two cases of each distinct category (cf. model I through VII) occur in the test. Two sentences of the same type are never tested consecutively. All sentences are in the simple past. No aids may be used during the test. For each sentence, the subjects are asked to

- choose P or I aspect
- draw the matching model
- motivate their decision

5.5. Experimental subjects

Until 1974 first or second year psychology students took part in the experiments based on the consecutive versions of our 'mini-course'. The size of the different groups was 12 at the most. The subjects had all completed the pre-university stream of secondary school. All subjects were native speakers of Dutch and had no prior knowledge of Russian or any other Slavic language. The subjects participated voluntarily in this particular experiment. Their program of study does, however, require them to perform as experimental subject at least n-times.

5.6. Results as of June, 1974

The scores obtained by the last group of 12 subjects are depicted in a histogram (see figure 7). The nature of the errors will not be discussed here. We do, of course, have error analyses for each test item available.

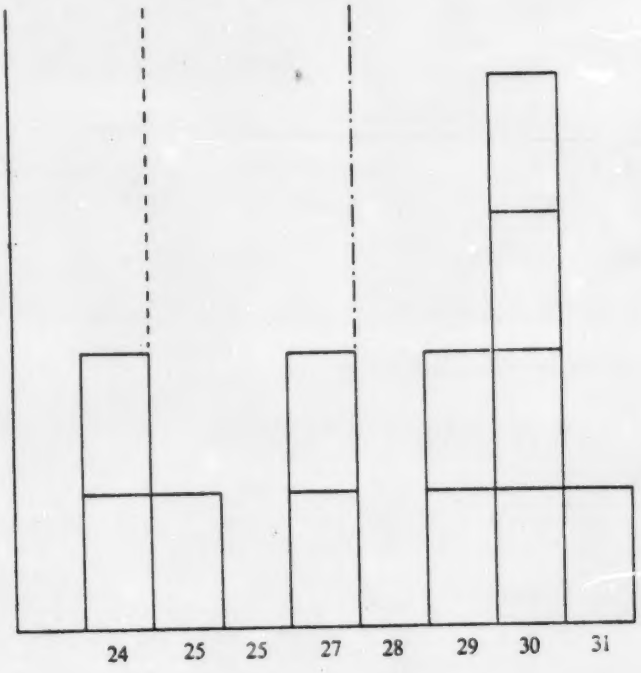
As can be seen immedidately from the histogram, 10 subjects meet our 80% criterion, which we had established as the measure of success for our course. Two subjects fall only one point short of this criterion. It may be added that all subjects were highly motivated in their work and discussions after the test revealed their great interest in the backgrounds of the present teaching method.

Finally, with regard to the results obtained, one more detail may be mentioned concerning the correlations found between the three subparts of the test: a. choice of the P or I aspect; b. drawing the matching model; c. verbally naming the category involved. The following (Spearman) rank correlations were found:

Aspect - Verbal $R = 0.561$ ($p < .05$)
Aspect - Model $R = 0.569$ ($p < .05$)
Verbal - Model $R = 0.778$ ($p < .01$)

The correlation verbal-model is relatively high and statistically significant. The subjects also behave quite consistently with regard to schematizing and verbalizing. Both model and verbalization were wrong in 28 cases. In only three cases did inconsistency arise between the selected model and its label.
All results indicate that we succeeded fairly well (in three hours!) in teaching the concepts involved by causing models and verbal 'labels' to interact.
The extent to which subjects operate by means of a verbal or visual code at the end of the 'mini-course' cannot unambiguously be determined on the basis of this investigation. It is our plan to obtain more certainty about this by manipulating this variable more systematically.

Figure 7: Performances of students



Rectangulars represent one subject

Max. = 31 items correct (some test sentences contained more than one verb form)

..... = 80% criterion

-·-·-·-·-·-·-·- = 90% criterion

5.7. Results as of June, 1976

After the experiment in which university students participated, we started a new series of experiments in which 9th graders from both college preparatory and commercial streams served as subjects. The results of these experiments were very positive with both groups of subjects. An average of 3/4 of the subjects earned grades of B or better on the tests, the remaining quarter earning fair to satisfactory grades (C/D+ at worst).

The test consisted of three different tasks, two of which involved operating from language use to theory, and one moving from theory to language use. The subjects were presented with Dutch sentences and with pictures to which they were to assign the proper verb aspect, i.e. the verb aspect a Russian speaker would choose to convey the same message. They were also given a number of Dutch verbs and asked to construct sentences whose equivalents in Russian would require a perfective or imperfective aspect, as instructed. The positive test results applied not only to all groups of subjects, but also to both types of task.

There were no clearly unsatisfactory marks (F), and the distribution of the test marks as far as the difference between "good" and "weak" pupils is concerned, was considerably less broad than their school-marks for foreign languages. Russian experiments in this area show the same kind of results, a fact I consider of great importance, especially in view of the fact that high correlations between IQ-tests and school language marks are still being found (see Jacobovits, 1971).

The procedure used, has proved in practice to be an economical and a motivating one. We all know that grammar learning has always been notoriously unpopular. The fact that Gal'perin's method seems actually to motivate pupils makes it even more promising. The procedure organizes and sequences the exercises in such a way that teachers and researchers can work together in improving schoollearning of foreign languages.

In The Netherlands, approximately 30% of the average secondary school student's curriculum is devoted to required foreign languages, which for many of them means a martyrdom of frustration and failure. In the United States, with its far less stringent requirements on foreign languages at the secondary level, an effective and stimulating approach may encourage more pupils to choose for and succeed better at foreign languages, possibly eliminating the belief that foreign languages are categorically unlearnable for some.

6. Conclusion

Our aspect experiment would indicate that a lot of work still remains to be done in this area. Algorithms and models of the kind discussed here can no more be built in a day than Rome.
This is clearly the beginning of a new development in research on F.L.-teaching methodology. Much research, both in applied linguistics and psychology, will be necessary before the teaching and learning of grammar will actually be optimalized. The question arises as to how such material can be developed. According to Landa (1972, 1979), a noted scholar on algorithms in school instruction, the construction of algorithms is the task of specialists who have the necessary knowledge of psychology as well as of linguistics. According to Landa, the development of teaching-learning procedures is possible only if one knows the exact structure of the internal processes which must be formed. In other words, one must have access to a reasonably precise model of the student's functioning, determining what "cues" the student must pay attention to, what operations he must perform, and in what order.

In theory, there are two ways to construct activity-algoritms. The first is to make a psychological analysis of the behavior of someone who can already perform as desired. In this analysis, special attention must be paid to the process by which the subject arrives at the given result. On the basis of these data, conclusions may be drawn about the existence of the underlying (i.e. 'covert') activity structure.
The second option, which seems to lead toward the goal faster, is to start with a psychological analysis of the learning objective. Such an operational model (Kuljutkin, 1970) must contain the necessary information on the comprehensive form of the action including all successive operations which must be accomplished in order to deliver the desired performance on the material level (cf. Gal'perin in section 3).
This analysis resembles the composition of a program for a computer, in which all operations must be explicitly described in terms adapted to the characteristics of the machine. That the construction of operational models for grammatical actions has a high diagnostic value for research and development in F.L.-teaching becomes immediately obvious as soon as one becomes acquainted with such models.

References

Ausubel, D.P., The Psychology of Meaningful Verbal Learning. New York/London, 1963.

Carpay, J.A.M., Foreign-Language Teaching and Meaningful Learning. In: ITL Review of Applied Linguistics 25-26 (1974), pp. 160-187.

Cole, M. & Maltzman, I. (eds.), A Handbook of Contemporary Soviet Psychology. New York/London. Basic Books, 1969.

Dawydov (Davydov), W., Arten der Verallgemeinerung im Unterricht. Volk und Wissen Verlag, Berlin (D.D.R.), 1977 (Russ. orig. 1972).

Gal'perin, P., K psichologii izučenija inostrannogo jazyka. Naučno-metodičeskaja konferencija po voprosam obučenija inostrannym jazikam v vysšej škole. Moskva, 1967.

Gal'perin, P., Jazykovoje soznanije i nekotoryje voprosy vzaimootnošenija jazyka i myšlenija. Soveščanije po probleme vzaimootnosjenija jazyka i myšlenija. Moskva, 1977.

Gochlerner, M., Poetapnoje formirovanije grammatičeskich mechanizmov reči na inostrannom (nemeckom) jazyke. In: A.Ždan and M. Gochlerner Psichologičeskije mechanizmy usvojenija grammatiki rodnogo i inostrannogo jazykov. Moskva, 1972.

Gol'din, Z., Metbdika obučenija inostrancev russkomu skloneniju. Avtoreferat, Moskva, 1970.

Jakobovits, L., Foreign Language Learning. A Psycho linguistic Analysis of the Issues. Rowley, Mass., 197'.

Kabanova, O., Formirovanije grammatičeskoj struktury vyskazivanija. Avtoreferat, Moskva, 1971.

Kempen, G., De taalgebruiker in de mens (The Human Language User). Groningen (The Netherlands), 1976.

Kučerova, T., Usvojenije vido-vremennoj sistemy anglijskogo glagola po metodike poetapnoj formirovanije umstvennych dekstvija. K probleme upravlenija obučenijem i vospitanijem. Moskva, 1970.

Kuljutkin, Ju.N. & Suchobskaja, G.S., Ob izpol'zovanije schematičeskoj nagladnosti pri formirovanii grammatičeskich umenij. In: Voprosy Psichologii, 1967, no. 1.

Kuljutkin, Ju.N., Evrističeskije methody v strukture rešenij. Moskva, 1970.

Landa, L.N., Algorithmierung im Unterricht. Berlin (DDR), 1969 (Russ. orig. 1966)

Landa, L.N., (ed.) Voprosy algoritmizacii i programmairovanija obučnija. Vyp. 2. Moskva, 1972.

Landa, L.N., Some Problems in Algo-Heuristic Theory of Thinking, Learning and Instruction. In: Structural Process Models of Complex Human Behavior. J.M. Scandura & Ch.J. Brainerd (eds.), Alphen aan den Rijn (The Netherlands), 1978.

Leont'iev, A., Sprache-Sprechen-Sprechtätigkeit. Kohlhammer Verlag, Stuttgart, 1971 (Russ. orig. 1969).

Markova, A.K., The Teaching and Mastery of Language. In: Soviet Education. Vol. XXI (1978-79) no. 2-3-4.

Parreren, C.F. van, Grammatical Knowledge and Grammatical Skill. In: A. van Essen/J. Menting (eds.) The Context of Foreign-Language Learning. Van Gorcum, Assen (The Netherlands), 1975.

Resnick, L.B., Task Analysis in Instructional Design: Some Cases from Mathematics. In: D. Klahr (ed.), Cognition and Instruction. Hillsdale N.Y., 1976.

Vjatutnev, M., (ed.) Russkij Jazyk 2 Audio-vizual'nij kurs dlja zarubežnich škol. Moskva, 1972.

Vygotsky, L.S., Mind in Society. Harvard University, Cambridge Mass. London, 1978.

Wertsch, J.V., From Social Interaction to Higher Psychological Processes. A Clarification and Application of Vygotsky's Theory. In: Human Development 22 (1979), pp. 1-22.

Cognitive Mastery of Grammar Rules in Foreign Language Learning. Some Experimental Work Based on the Vygotskian Model.

Jacques Carpay
Department of Education
Free University
Amsterdam, The Netherlands

Paper presented at the Annual Meeting of the A.E.R.A., Boston, 1980.

1. Introductory remarks

The aim of this presentation is to give a brief outline of some research in the field of foreign language teaching and learning based on principles derived from a single, very comprehensive theory, the cultural-historical theory of higher mental functions pioneered by Lev Semënovič Vygotsky in the 1920s and 1930s (cf. Wertsch, 1979, Vygotksy, 1978).

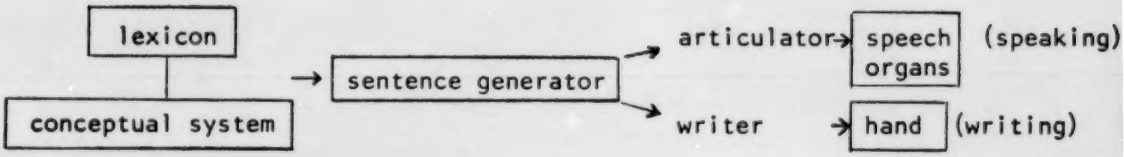
The research discussed here, primarily that of the educational psychologist P.J. Gal'perin (University of Moscow) and his associates, is an experimental demonstration of basic tenets of Vygotsky's theory. This new kind of educational-psychological research began to take shape in the USSR around 1960 (cf. Cole and Maltzman, 1969).
In keeping with the dictum that one must test theory in practice, this research uses the classroom and the activities of the classroom to carry out the scientific analysis of foreign language learning and teaching. This analysis is based on two aspects of Vygotsky's theoretical framework. First, it reflects his emphasis on genetic explanation of psychological phenomena. Second, it reflects his concern for the role that social interaction plays in the development

of all higher mental functions, which according to Vygotsky, appear first on the 'interpsychological' (i.e., social) plane and only later on the 'intrapsychological' (i.e., individual) plane. Thus, the transition from interpsychological to intrapsychological functioning is the main cornerstone of the approach (cf. Wertsch, ibidem). Theoretically, the thinking presented in this paper is clearly in tune with current ideas about the development of metalinguistic and metacognitive skills prominent in Western psycholinguistic and psychological circles.
First of all I should like to discuss Gal'perin's work on the meaningful learning of grammatical features and patterns in a foreign language at school. I shall begin with his analysis of the learning task; then, I shall discuss in some detail the teaching strategies he has developed; finally, I shall outline the results of a series of experiments recently completed in schools in The Netherlands, including pupil-participants' response to their learning experience.

2. Analysis of the learning task

Pjotr Jakolevič Gal'perin has devoted several articles to the psychological basis of foreign language learning in schools. The earliest publication I have been able to find dates from 1967; the most recent appeared in 1977. In addition to these publications his theory has been applied and developed in a number of doctoral dissertations written under his direction, notably Gochlerner (1972), Gol'din (1970), Kabanova (1971) and Kučerova (1970).
Limiting myself to language production, i.e. speaking and writing, I shall make use of a model of the human language user developed by the Dutch psycholinguist Kempen (1976) as a means of quick access to Gal'perin's theory.

Fig. 1. The human language user (Kempen, 1976)



The "sentence generator" component will take us unto Gal'perin. Two key processes take place in this component: 1. the semantic content of the intended utterance is specified (the process of conceptualization) and 2. this conceptual content is formulated, that is to say, words are sought in the lexicon which are suited to convey the intended message and the words are arranged into a sentence (the process of formulation, including the processes of lexicalization and syntacticalyzation).

Whether these last two mechanisms are connected in series or parallel, or partly in series and partly parallel, will remain a moot point here. Those wishing a further discussion of this issue are referred to Kempen (1976) or Leont'iev (1971).

The processes which take place in the "conceptualizer" and in the "formulator" proceed as it were automatically in the native language. In using everyday language, in particular, we are virtually unaware of the psychological activity involved in matching available words and constructions to intended messages. Nor do we stop to consider the fact that what we have to say and the means at our disposal to say it in our native language are so marvelously attuned to one another. We do not as a rule become aware of this until we come into contact with other languages, or until we become acquainted with scientific thought and fact. Consider, for example, the contradiction between language and fact in expressions like "The sun rises ... and sets" (which of course it doesn't), or even a word like woodchuck (an animal, I'm

told, which does not chuck wood, or indeed have anything to do with wood).

A few simple examples will illustrate this further. A speaker of English may say "That's my car" when speaking of a possession, but also "That's my bus" when speaking of a vehicle he clearly does not possess, but is merely going to make use of. Many European languages, including Dutch, French, German and the Slavic languages, make use of the same "conceptualization" for both speaker-object relationships, and of the same linguistic means, the possessive adjective, to express them. No one stops to think that the relationships are not the same. But there are languages (e.g. Turkish) in which the speaker-bus relationship is expressed differently from the speaker-car relationship, in which, for example, one may say my car, but not my bus. The latter would be expressed by means of a construction whose conceptual content might be rendered as "the bus for my benefit". The distinctiveness of the message in this case is based on a different organization of reality than obtains in our native languages.

Of course we needn't resort to exotic languages for similar conceptual differences. The English speaker would say "the letter is in the envelope". For the speaker of Dutch, the letter sits in the envelope, and for the speaker of Russian, it lies there. The Dutch speaker says "We were with seven people" to mean a total of seven people were present. To the English speaker this expression would mean at least 9 people were present. One could say the Dutch with includes, whereas the English with coordinates or attaches, at least in this case. One's native language invariably seems to reflect reality "best", but who is to judge? And does it really matter? With Gal'perin, I simply ascertain that learning a foreign language by and large requires the learner to become aware of the thought contents, the conceptualizations which in Gal'perin's terms constitute the "linguistic consciousness" of the Englishman, American, Dutchman, Frenchman, et cetera. To return to the example of the letter in the

envelope, we see that the foreign learner of one of these languages would have to become familiar with the system, in this case the semantic system which underlies the constructions (here verbs) which refer to the conditions objects may be in. An English speaking learner of Dutch, for example, would have to divide his concept of "rest", generally associated for him with the verb be, into three different categories having to do with the shape or position of the resting object: for a Dutchman, a cork sits on a bottle, a handkerchief sits in someone's pocket, but a broom stands in a closet, a bottle stands on a shelf, and a comb would lie in a drawer, money lies in a bank, and a ship lies in port. A Russian speaker deals with this segment of the material world differently again.

Gal'perin calls the systematic explicitation of these and other comparable thought contents in the native language as a basis for later expression in foreign language communication "pereososnanaye", which, for lack of a single perfectly equivalent term in English (there is none in Dutch either) I shall render as "reconceptualization of the native language". Gal'perin distinguishes between, on the one hand, knowledge of and thought about the material and mental world (which he calls cognitive consciousness) and on the other hand the thought content which is reflected in language (linguistic consciousness in Gal'perin's terminology). This distinction gives rise to the question of its implications for foreign language instruction. Gal'perin deals with these in his latest publication (1977):

1. The semantic basis of all lexical and grammatical categories of the foreign language must be determined. Although this is no simple task, it is not, according to Gal'perin, impossible to map out the most important conceptual systems. Once we have determined the semantic basis of, for example, cases in Russian, or verb tenses in English, we have at our disposal an analytic tool which can provide a learner with the criteria he needs to analyze (his own) speech intentions in order to choose the correct form in the foreign language. The foreign language learner is made to see his

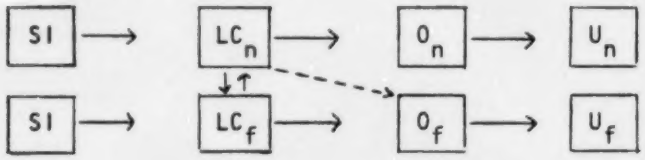
speech intentions through Russian or English eyes, or, so to speak, through Russian or English-colored glasses. To put it in terms of applied linguistics, we may say that Gal'perin advocates contrastive analyses of thought acts and not exclusively of observed language utterances.

2. The learning process must not be started with imitation or application of foreign language operations on speech intentions which have been highly pre-structured by the teacher or the textbook. When dealing with semantic problems, which are the most difficult, Gal'perin advocates starting in the native language. In terms of Kempen's model, we may say that Gal'perin first focuses on the process of conceptualization before proceeding to the process of formulation. He first has his pupils analyze Russian sentences, for example on the basis of the criteria which determine tense choice in English. Only after his pupils have mastered these criteria does he introduce material in English. The pupils do not translate in the first phase, they merely indicate whether form A of B is required, motivating their choice as well. One clear advantage of this strategy is that there is no need to restrict the material to words the pupils have had. Innumerable speech intentions can be analyzed, and pupils themselves may contribute examples. In Davydov's terms (1977) we may say that the first step aims at bringing about "theoretical generalization". The study material is organized from the general to the specific. Therefore two types of learning activity are necessary: (1) learning activities to reveal the most general, genetically primary relationships in particular (specific) material; and (2) learning activities to give concreteness and specificity to the general relationships discovered previously.
Using these two kinds of learning activity, pupils assimilate the system of concepts in the course of study and, secondarily, the semantic make-up of the various kinds of speech intentions, that define and exemplify the area of application of a certain grammatical rule.

A concrete example of experimental instruction based on the theoretical framework discussed so far will be presented in section 5.

3. Given a systematic, insight-based differentiation between the native and the foreign language consciousness, the much-feared phenomenon of interference will simply not occur. (See Fig. 2.) Gal'perin aims at making an ally rather than an enemy of the native language. In his view, this is possible only if learners are first made explicitly aware of their native language consciousness. In Gal'perin's view, learners fail to master foreign languages primarily because little or no attention is paid to systematic semantic analysis in school native language courses. And if any attention is paid to semantic contrastive analysis in foreign language courses, it is by no means sufficiently systematic.

Fig. 2. Schematic representation of Gal'perin's theory



SI speech intention
LC linguistic consciousness; n native language
f foreign language
O operation(s)
U utterance
------> interference

This completes my of necessity condensed exposition of Gal'perin's analysis of the learning task. In the next two sections I should like to outline some of the characteristic features of his teaching strategies. It is important to keep in mind that Gal'perin and his

associates always experiment in schoolclasses and that a schoolteacher rather than an outsider functions as experimenter.

3. The conceptual framework of Gal'perin's teaching-learning theory

In addition to his theory on interference, Gal'perin has also developed a teaching-learning theory which mainly integrates meaningful learning integrated into activity. A brief exposition of this by Gal'perin in English translation can be found in the 'Handbook of Contemporary Soviet Psychology' (Cole and Maltzman, 1969). Further reference can be made to a recent publication by Markova (Markova, 1978-79). According to Gal'perin, grammatical knowledge is formed first by teaching the students material grammatical actions, which are ultimately to become mental actions. These mental actions are developed by passing through a series of stages in which the action takes successively different shapes (i.e. material, verbal, mental). Furthermore, at each stage of the learning process, the student is provided with a complete orienting basis, i.e. all the directions needed to perform a given task. Such a complete orienting basis ensures insight-based performance.

4. Characteristic features of the experimental teaching-learning materials

The development of such an orienting basis presupposes a thorough understanding of the learning activity. One factor of basic importance in understanding a learning activity is the analysis of external and internal aspects of the performance of an activity, especially the role of symbolic (mental) representations of the suject matter (cf. Jean Piaget and Jerome Bruner) and the process of internalization (cf. Vygotsky, A.N. Leont'iev, Gal'perin). The complete orienting basis for the three-stage learning process also necessitates the use of external supports (cf. Vygotsky, 1978) two types of which can be distinguished according to Markova (1978-79, pp. 100 ff.): concrete representation of the structure of the object being studied, and

concrete representation of the structure of the activity. These notions will be illustrated in section 5 when I discuss an experiment done by myself (Carpay, 1974) and 'authorized' afterwards by Gal'perin.

"Materialization" is, then, the first distinctive feature of Gal'perin's teaching strategy. As in other areas, and I might add, in contrast to the usual classroom procedures in the Soviet Union, Gal'perin makes memorization unnecessary. Pupils are given a scientifically based, reliable "cheat sheet" to consult. Rejecting the assumption that "if you've had it, you must know it", Gal'perin's procedure organizes and sequences the exercises in such a way that pupils ultimately have no need to refer to these "cheat sheets", or in Gal'perin's terms "learning cards".

Gal'perin's procedure is also characterized by the way the division of labor is organized. Usually, one pupil does the work and the other checks it. Each pupil takes his turn in performing all the functions of a collective activity.

In the classroom Gal'perin makes use of three consecutive learning activities. Each new topic is first introduced by the teacher to the whole class. Then the pupils work on assignments, in pairs or groups of 3 or 4. In this phase pupils alternate taking the role of teacher-monitor and of learner. One aim of this activity is to create a natural setting in which pupils must verbalize their thinking aloud. The assignments may consist of analyzing sentences set by the teacher and formulating sentences which meet certain requirements. The third phase of the procedure involves working alone. Note that in the three-step procedure, the teacher's role shifts systematically to the individual pupil.
The procedure is an operationalization of the aspect mentioned in section one: the transition from the social to the individual plane, from external control to selfcontrol.

In introducing new material, Gal'perin and his students usually work with an 'instruction', such as is commonly used in psychological 'laboratory' experiments. That is to say the teacher-experimenter demonstrates or explains what must be done and why. I would advocate, however, as would Davydov and Markova (see Markova, ibidem) guided discovery through discussion for this phase. Eliciting examples from his pupils and supplementing these with his own where needed, the teacher constructs together with his pupils the "learning card" (cheat sheet) they will later use. I believe that this technique is pedagogically preferable to the one-way 'expository' lesson-format, especially as it provides more and better opportunities for feedback, and for response to the needs of individual learners.

I believe that Gal'perin's teaching strategy offers a number of possibilities for individualization and differentiation in the classroom, in terms of tempo, task and role. Pupils can work more quickly or more slowly as needed, can take the role of teacher or learner in pairs or small groups more or less frequently as needed, can be given more abstract or more concrete tasks to perform, and so on.
And it goes without saying that this approach is eminently suited for further experimentation in the school classroom.

5. The aspect experiment

From 1970 to 1976 I carried out a series of experiments in which I applied Gal'perin's theory to the teaching of semantic criteria for choosing the correct aspect form of the Russian verb. In this research in which Dutch speaking first year university students and 9th graders from both college preparatory and commercial streams participated as subjects, I tested several variations of "learning cards" and classroom (experimental) procedures.
In the research use was made of similar work done by Russian as well as Western psycholinguists and psychologists. For further reference in

this respect I refer to a publication of my own (see Carpay, 1974). In my research I used

1. visual models which materialize the grammatical structure, and
2. an activity-algorithm which serves as a recipe for the performance of the given task.

5.1. Main characteristics of the experimental 'mini-course'

My research covers a topic which is both important and difficult: the selection of the appropiate verb aspect in Russian. The main characteristics of the experimental 'mini-course' are the following:

a. In contrast to the usual procedure, in which pictures are captioned in the foreign language (cf. Vjatjutnev, 1972) we introduced these aspects by means of pictures with Dutch captions. The decision for this deviating approach was taken on practical as well as theoretical grounds. The practical advantage of operating with Dutch captions is obvious in that it is independent of the student's knowledge of particular Russian verbs. One could even work with subjects who do not know Russian at all.

   The decision to use Dutch for teaching the subjects the concepts of aspect may also be justified theoretically on the basis of the psychology of language, learning and thinking. The concepts to be formed are absent as a grammatical category in the native language. In order to operationalize "aspect" one must, therefore, make the student conscious of the conceptual schemes used by speakers of Russian in the selection of a certain verb form. Considering the fact that the explication of the characteristics and features of conceptual schemes used by Russians requires a metalanguage, the option in this case was for native language 'labels'. Moreover, this choice is supported by Gal'perin himself who, as was discussed in section 2, advocates that the orienting basis be built on the native language.

b. In teaching the choice of aspect (imperfective/perfective) for finite forms in Dutch sentences, a number of visual models were developed. In addition, an activity-algorithm was developed to

teach the use of these models. This algorithm is nothing but a "recipe" of the complex action that must be learned. The idea of combining visual models with an activity-algorithm was taken by Gochlerner (cf. Van Parreren, 1975).

c. In order to optimize the use of the activity-algorithm and the visual models, they were integrated. The subject thus does not need to manipulate two aids simultaneously, as was the case for Gochlerner, for example. As our experiment uses seven models in total, ergonomic reasons alone would favor the procedure selected.

d. The subjects internalize the models by acting upon them. The algorithm does not have to be memorized but functions exclusively as an external support ("cheat sheet") in the first stages of the learning process. Its function may be compared to that of the instructions for use that come with a new tool and become superfluous after the actions involved have been performed a number of times.

e. Algorithm and models do not remain unchanged throughout the entire teaching-learning process. When the subjects have become familiar with the comprehensive version of the aid, it is replaced by a condensed version. In this way, an attempt is made to guide the learner into a shortened, reduced version of the action. The desirability of such guidance is supported by research, particularly that conducted by Kuljutkin and Suchobskaja (1967). This research clearly reveals that subjects who have to apply algorithms (want to) skip 'steps' in the learning process at a certain moment (see also Resnick, 1976). We felt that this transformation of the activity structure should occur under optimal control.

f. In order to control the variable of 'teacher', a form of programmed instruction was used. Each subject has a 'learning package' containing all necessary information and aids (see 5.4.).

g. In order to organize the necessary verbalizations (speaking aloud) optimally, the experimental course contains 'steps', some of which must be taken individually, others in pairs.

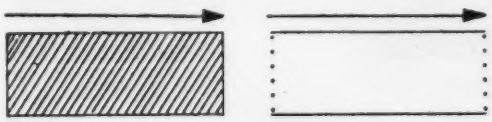
h. Partner selection is free in our course. The subjects can choose a partner who has, at that particular moment, also attained a certain level or they can choose a partner with whom they like to work toghether. In the latter case, they may have to wait until this person is ready.

i. The total experiment lasts three hours at the most. But the program is divided into two sessions of 1.5 hours each. There is a test at the end of the second session. Subjects are asked not to talk to each other about the experiment in between the two session, which take place on two consecutive days. This measure is taken to keep the course of the learning process as pure as possible.

j. Although the program is 'teacher-free', the students of course have the right to communicate with the experimenter since there is no such a thing as 100% accuracy in choosing aspect. If at any point in the program the students choose an aspect which is different from the one given in the 'key', they can discuss their solution with the experimenter.

5.2. Visual models

The following visual models were developed for orienting the subjects into the deeper, underlying features that in fact account for the choice of the aspect forms in the past tense. In Dutch, the simple, i.e. inflected, form of the past would or could be used in all of the cases cited.*)
Two basic models, the perfective and the imperfective aspect respectively, form the starting point (cf. models I and II).



Model I *Model II*

In these models

(i) Rectangulars represent the event;

(ii) The arrows above the block represent the time axis;

(iii) Model I represents the perfective aspect, where the beginning

*) This experiment was limited to the choice of aspect in the past tense. Choosing aspect in the future tense can by and large be considered an analogous activity as it is 'mirrored'.

and the end of the event are clearly indicated. (Vertical lines on either end, represent the criterion: "The event reaches its natural end");

(iv) Model II represents the imperfective aspect, where the beginning and the end of the event are not clearly indicated. (Dotted vertical lines, represent the irrelevance or uncertainty of the event's reaching its natural end)

Moreover model I is filled, model II is not: this symbolizes once more the perfective versus the imperfective aspect.

Although these models contain all the features necessary to a motivated selection of the perfective or imperfective aspect we felt a need for a number of additional models (see models III through VII) which include the different semantic features determining the choice of aspect in certain concrete uses.

Model III

This model represents events classified as 'short indivisible moment'. This category of past aspect use refers to such events (sentences) as Er klonk een schot (a shot rang out) or Hij gaf haar een kus (he gave her a kiss). Model III is meant specially to teach the students how to differentiate between, for example, Hij at een meloen (he ate a melon), a durative action which ends and Hij gaf haar een klap (he struck her a blow), an instantaneous action.

In order to equip the students for sentences with more than one verb models IV to VII were developed.

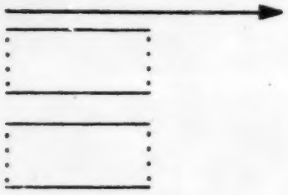
Model IV

Model IV symbolizes: 'repeated action' (cf. Vroeger ging Olga altijd 's zondags naar de kerk: Olga used to go to church on Sunday).

Model V

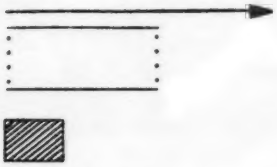
Model V represents 'successive actions' (cf. Hij dronk zijn glas leeg en vertrok: He emptied his glass and left (He drank his glass empty and left). The natural ending of the first action (dronk, drank) is indicated by the beginning of the second (third, etc.) activity.

Models VI and VII were developed to represent 'simultanity' of two or more actions.



Model VI

Model VI represents sentences such as Iwanov keek toe, hoe Smirnov werkte (Iwanov was watching Smirnov work). This model then, depicts 'totally simultaneous' actions which are both indicated in Russian by the imperfective aspect.
Model VII is used for the category 'partial simultaneity'.



Model VII

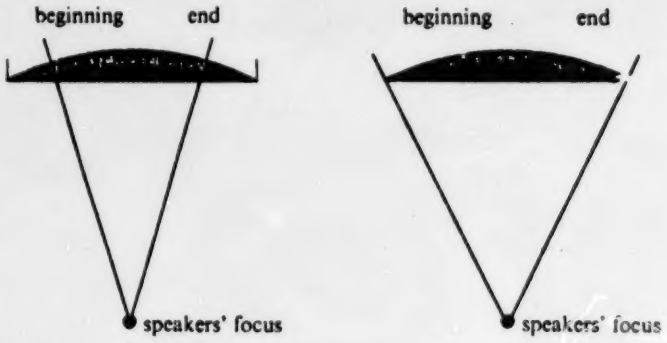
This model represents sentences such as Toen Olga binnen kwam, zat Pjotr de Pravda te lezen (When Olga entered, Pjotr was reading Pravda). Special for this category is that one action finds its natural end (= a telic or terminative event) and requires the perfective aspect (binnenkwam, entered), while the other is not limited in time (= an

atelic event) and requires the imperfective aspect (lezen, reading). Those familiar with the Russian language will have noticed that our system of 'aspect rules' is not entirely complete. It seems to us, however, that the categories of language use which are not covered by our rules (models) can easily be learned as 'special cases' after the students have internalized the basic rules. Our rules, then, may be considered 'advance organizers' (from Ausubel, 1963), that is to say as anchor points to which newly acquired information can be related.

5.3. The activity-algorithm

Model I through VII represent the separate, elementary operations (cf. Landa, 1969) involved in determining aspect. It is now necessary to represent the activity of 'choosing aspect' in one operational model. The first step of our activity-algorithm (see Figure 4) requires the student to imagine the event as the native speaker would (cf. Isačenko, 1962). He is aided in doing this by the visual models in Fig. 3. He then works through the "flow chart" until his choice of aspect is determined.

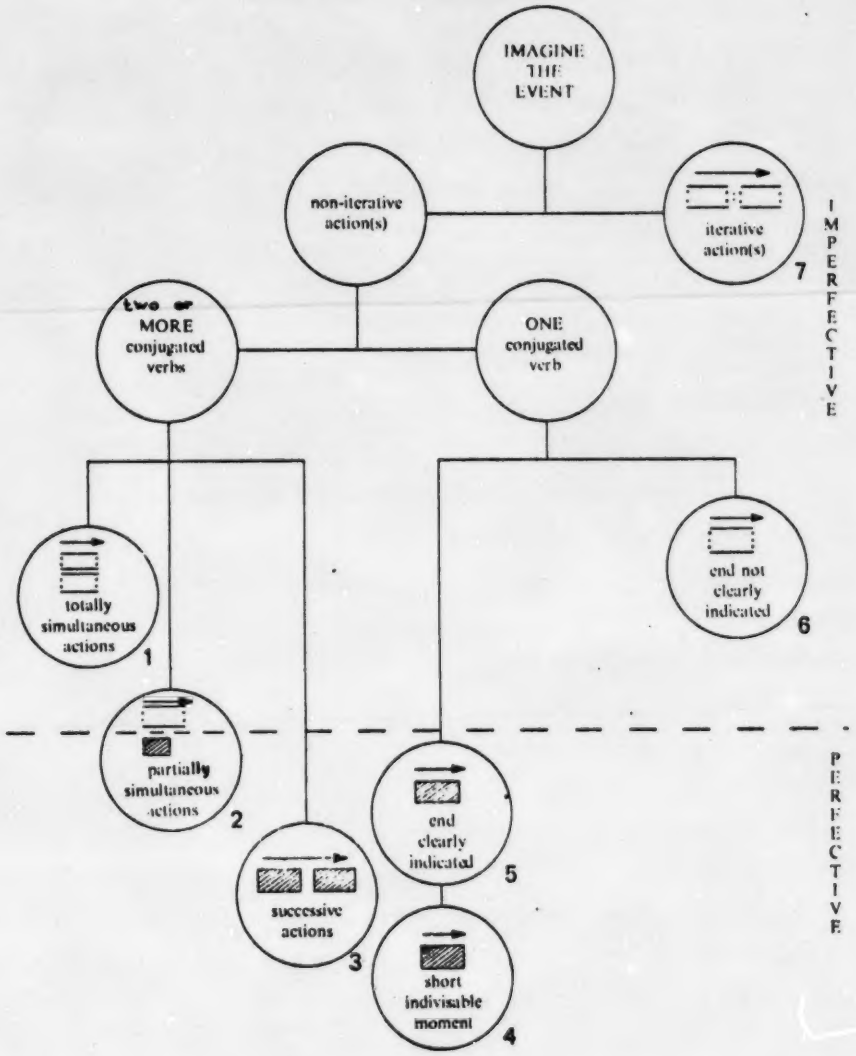
Fig. 3: Speakers' focus in choosing aspect



picture I *picture II*

A number of observations can be made about the "tree" (Fig. 4), which is the fourth and for the time being last variant in this research. The "tree" branches the determination of an iterative versus a non-

Figure 4: ACTIVITY-ALGORITHM 1



iterative action higher than that of one or more than one conjugated verb in the sentence. In earlier versions of the algorithm, the reverse was the case. The present design was selected because subjects frequently did not recognize 'repetition' as a sufficient determinant of the imperfective aspect. *) The models for the feature of 'simultaneity' are on the left side of the tree. The model for 'partial simultaneity' lies partly in the imperfective field and partly in the perfective. Thus the experimental subjects are made conscious of the special position of this model, in which one verb requires the perfective and one the imperfective aspect. The model for the category 'short indivisible moment' was placed directly below the basic model of the category 'end clearly indicated' (perf. aspect) in order to help the subjects see that it is a special case of a basic model.
In avoiding any kind of maze in the design of the activity-algorithm we anticipate from the very beginning the 'abbreviation' of the action which must take place at a later stage of the learning process. The 'steps' are ordered and vizualized in such a way that the algorithm can, as it were, be telescoped. One drawback, however, could not be remedied. The necessay subdivision of the algorithm into two fields, for perfective and imperfective aspect, respectively, places the model for 'successive actions' at too large a distance from its (visual) antipole, the model for 'iterative action(s)'.

After the subjects have become familiar with the foregoing aids, the algorithm is replaced by a second one, in which the verbal labels for the different model have been removed. In order to enable our subjects to consult both versions of the activity-algorithm, as desired, we constructed a special aid. We drew tree 1 on a shee of paper, removing the upper half of each circle segment. Tree 2 is drawn on a sheet of paper attached to the back of tree 1 (see Figure 5).

*) N.B. We use only sentences with 'indefinite' frequency (signal words: always, in the past, every summer etc.). Sentences with 'definite' frequency (cf. twice etc.) do not (yet) occur in our 'mini-course'.

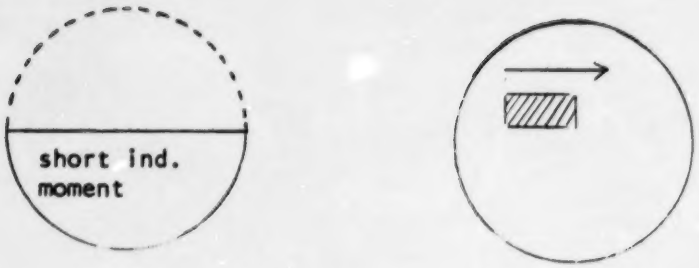


Fig. 5: Two parts from tree 1 and 2. The upper circle segment has been cut out.

Thus, subjects using tree 2 may overlay it wiht tree 1 at any time they feel the need of the verbal label in addition to the visual representation. Subjects easily switch trees. Very soon, however, they have no further need of tree 1.

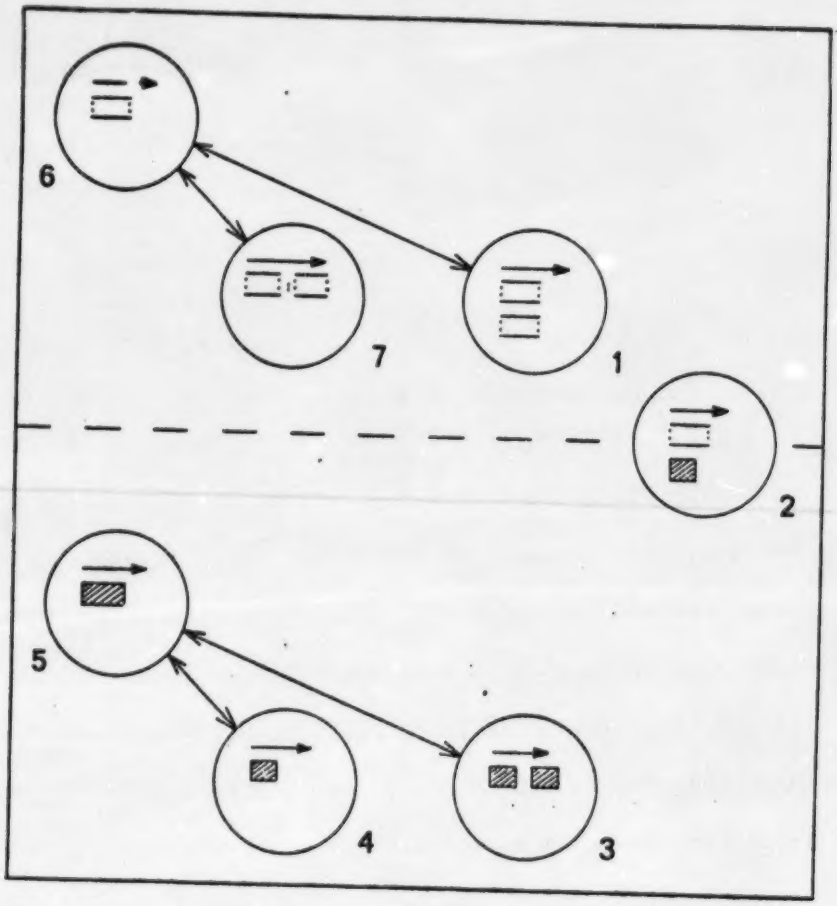
The subjects having exercised sufficiently with trees 1 and 2, the third tree is introduced in the second session. In this algorithm, there are no verbal labels and the perceptive field is organized differently. The function of tree 3 is to assist the subjects in reducing the number of categories from seven to three, namely,

(a) $P_1 \ldots\ldots\ldots\ldots P_n$ (all verbs perfective)

(b) $I_1 \ldots\ldots\ldots\ldots I_n$ (all verbs imperfective)

(c) P/I (one perfective, the other imperfective)

Fig. 6: ACTIVITY-ALGORITHM 3



5.4. Teaching-learning materials

The subjects are given a set of materials, consisting of the activity-algorithms discussed above and a number of booklets containing instructions and guide questions, explanatory text and matching pictures. The 'mini-cours' is subdivided into the following steps.

Step 1

A short explanation of the concepts of perfective (P) and of imperfective aspect (I). Emphasis is placed on the fact that aspect (Latin: aspicere = look) is a way of looking at an event (cf. figure 3). The subjects are also told that a speaker of Russian is, to a certain extent, free in his choice of aspect, but that by and large his choice reflects his psychological viewpoint.

Step 2

The experimental subject is shown a picture with a matching sentence. Zij speelden een harde wedstrijd tegen Ajax (They played a rough match against Ajax).

Then he is asked:

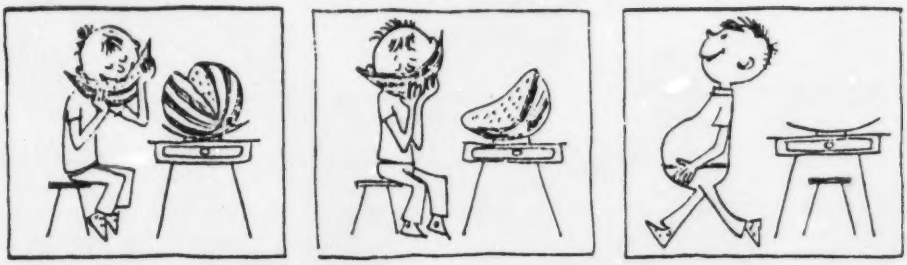
- which aspect do you think can be used here;
  perfective or imperfective?
- why?

When the subject turns the sheet, he sees the most likely solution. The first model is then immediately presented and explained. For the next six sentences, he is asked each time:

- which aspect - which model (of those presented so far) - why?

The first five sentences and matching pictures are examples of the perfective aspect, the last two of the imperfective. For the sentence: Pjotr at een meloen (Peter ate a melon) (Perfective) the following

picture series is used (Vjatjutnev, 1972).



Step 3

In this step, an number of models are expanded by means of pictures with matching sentences. Included are 'iterative action(s) (model 7) and 'short indivisible moment' (model 4). The model of 'clear ending' and 'ending not clearly indicated' (5 and 6) are further practiced.

Step 4

This step introduces the models for more than one conjugated verb (model 1, 2 and 3). As in steps 2 and 3, the subject is given carefully selected sentences and pictures. He is asked to consider the aspect and to point out the matching model which are presented in multiple choice form.

Step 5

In step 5, algorithm I is introduced in two parts. By means of familiar key sentences, the right side of the tree is practised first, then the left. (The subjects must name each step and find the 'best' solution on the back of each sheet.)

Step 6

From now on, pictures are no longer used but new sentences are introduced. The subject is asked 'to imagine a situation' (i.e. 'to form a speech intention'; cf. section 2) for each sentence. In this step the subjects operate in pairs, taking turns as 'student' and 'monitor'.

Step 7

Algorithm 2 is introduced in this step. The subjects work in pairs and are asked to point out the models which match the sentences without naming the labels. The first session ends with step 7.

Step 8

Sentences from steps six and seven are used. The subjects work in pairs. The 'student' must now draw the models involved; the 'monitor' supervises this activity.

Step 9

Algorithm 3 is introduced and practised. The decisions are now made in a different order: (1) perfective/imperfective aspect (2) model (3) verbal labels.

Step 10, 11 and 12

In these steps, subjects practice using algorithm 3, but now in pairs again. Step 12 is followed by the test.

The test

After step 12, the subjects are given a booklet with a test sentence on each page. The test contains a total of 18 new, Dutch sentences. At least two cases of each distinct category (cf. model I through VII) occur in the test. Two sentences of the same type are never tested consecutively. All sentences are in the simple past. No aids may be used during the test. For each sentence, the subjects are asked to

- choose P or I aspect
- draw the matching model
- motivate their decision

5.5. Experimental subjects

Until 1974 first or second year psychology students took part in the experiments based on the consecutive versions of our 'mini-course'. The size of the different groups was 12 at the most. The subjects had all completed the pre-university stream of secondary school. All subjects were native speakers of Dutch and had no prior knowledge of Russian or any other Slavic language. The subjects participated voluntarily in this particular experiment. Their program of study does, however, require them to perform as experimental subject at least n-times.

5.6. Results as of June, 1974

The scores obtained by the last group of 12 subjects are depicted in a histogram (see figure 7). The nature of the errors will not be discussed here. We do, of course, have error analyses for each test item available.

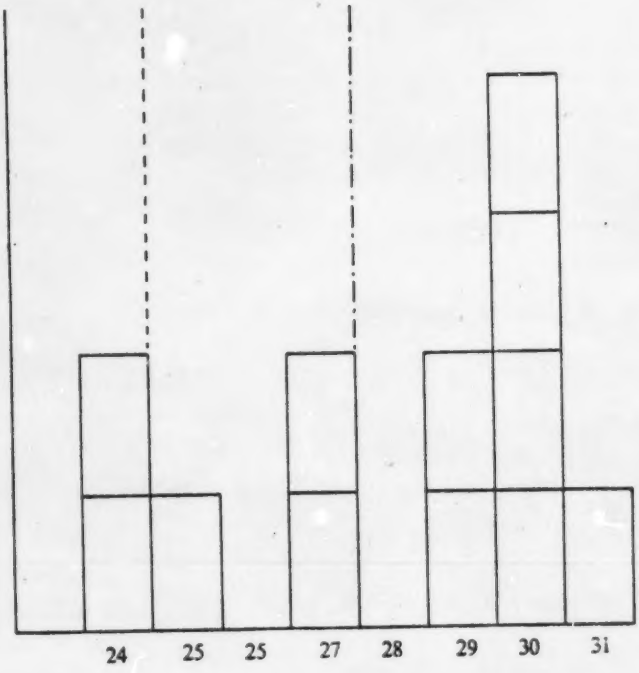
As can be seen immedidately from the histogram, 10 subjects meet our 80% criterion, which we had established as the measure of success for our course. Two subjects fall only one point short of this criterion. It may be added that all subjects were highly motivated in their work and discussions after the test revealed their great interest in the backgrounds of the present teaching method.

Finally, with regard to the results obtained, one more detail may be mentioned concerning the correlations found between the three subparts of the test: a. choice of the P or I aspect; b. drawing the matching model; c. verbally naming the category involved. The following (Spearman) rank correlations were found:

Aspect - Verbal $R = 0.561$ ($p < .05$)
Aspect - Model $R = 0.569$ ($p < .05$)
Verbal - Model $R = 0.778$ ($p < .01$)

The correlation verbal-model is relatively high and statistically significant. The subjects also behave quite consistently with regard to schematizing and verbalizing. Both model and verbalization were wrong in 28 cases. In only three cases did inconsistency arise between the selected model and its label.
All results indicate that we succeeded fairly well (in three hours!) in teaching the concepts involved by causing models and verbal 'labels' to interact.
The extent to which subjects operate by means of a verbal or visual code at the end of the 'mini-course' cannot unambiguously be determined on the basis of this investigation. It is our plan to obtain more certainty about this by manipulating this variable more systematically.

Figure 7: Performances of students



Rectangulars represent one subject

Max. = 31 items correct (some test sentences contained more than one verb form)

..... = 80% criterion

-·-·-·-·-·-·-·- = 90% criterion

5.7. Results as of June, 1976

After the experiment in which university students participated, we started a new series of experiments in which 9th graders from both college preparatory and commercial streams served as subjects. The results of these experiments were very positive with both groups of subjects. An average of 3/4 of the subjects earned grades of B or better on the tests, the remaining quarter earning fair to satisfactory grades (C/D+ at worst).

The test consisted of three different tasks, two of which involved operating from language use to theory, and one moving from theory to language use. The subjects were presented with Dutch sentences and with pictures to which they were to assign the proper verb aspect, i.e. the verb aspect a Russian speaker would choose to convey the same message. They were also given a number of Dutch verbs and asked to construct sentences whose equivalents in Russian would require a perfective or imperfective aspect, as instructed. The positive test results applied not only to all groups of subjects, but also to both types of task.

There were no clearly unsatisfactory marks (F), and the distribution of the test marks as far as the difference between "good" and "weak" pupils is concerned, was considerably less broad than their school-marks for foreign languages. Russian experiments in this area show the same kind of results, a fact I consider of great importance, especially in view of the fact that high correlations between IQ-tests and school language marks are still being found (see Jacobovits, 1971).

The procedure used, has proved in practice to be an economical and a motivating one. We all know that grammar learning has always been notoriously unpopular. The fact that Gal'perin's method seems actually to motivate pupils makes it even more promising. The procedure organizes and sequences the exercises in such a way that teachers and researchers can work together in improving schoollearning of foreign languages.

In The Netherlands, approximately 30% of the average secondary school student's curriculum is devoted to required foreign languages, which for many of them means a martyrdom of frustration and failure. In the United States, with its far less stringent requirements on foreign languages at the secondary level, an effective and stimulating approach may encourage more pupils to choose for and succeed better at foreign languages, possibly eliminating the belief that foreign languages are categorically unlearnable for some.

6. Conclusion

Our aspect experiment would indicate that a lot of work still remains to be done in this area. Algorithms and models of the kind discussed here can no more be built in a day than Rome.
This is clearly the beginning of a new development in research on F.L.-teaching methodology. Much research, both in applied linguistics and psychology, will be necessary before the teaching and learning of grammar will actually be optimalized. The question arises as to how such material can be developed. According to Landa (1972, 1979), a noted scholar on algorithms in school instruction, the construction of algorithms is the task of specialists who have the necessary knowledge of psychology as well as of linguistics. According to Landa, the development of teaching-learning procedures is possible only if one knows the exact structure of the internal processes which must be formed. In other words, one must have access to a reasonably precise model of the student's functioning, determining what "cues" the student must pay attention to, what operations he must perform, and in what order.

In theory, there are two ways to construct activity-algoritms. The first is to make a psychological analysis of the behavior of someone who can already perform as desired. In this analysis, special attention must be paid to the process by which the subject arrives at the given result. On the basis of these data, conclusions may be drawn about the existence of the underlying (i.e. 'covert') activity structure.
The second option, which seems to lead toward the goal faster, is to start with a psychological analysis of the learning objective. Such an operational model (Kuljutkin, 1970) must contain the necessary information on the comprehensive form of the action including all successive operations which must be accomplished in order to deliver the desired performance on the material level (cf. Gal'perin in section 3).
This analysis resembles the composition of a program for a computer, in which all operations must be explicitly described in terms adapted to the characteristics of the machine. That the construction of operational models for grammatical actions has a high diagnostic value for research and development in F.L.-teaching becomes immediately obvious as soon as one becomes acquainted with such models.

References

Ausubel, D.P., The Psychology of Meaningful Verbal Learning. New York/London, 1963.

Carpay, J.A.M., Foreign-Language Teaching and Meaningful Learning. In: ITL Review of Applied Linguistics 25-26 (1974), pp. 160-187.

Cole, M. & Maltzman, I. (eds.), A Handbook of Contemporary Soviet Psychology. New York/London. Basic Books, 1969.

Dawydov (Davydov), W., Arten der Verallgemeinerung im Unterricht. Volk und Wissen Verlag, Berlin (D.D.R.), 1977 (Russ. orig. 1972).

Gal'perin, P., K psichologii izučenija inostrannogo jazyka. Naučno-metodičeskaja konferencija po voprosam obučenija inostrannym jazikam v vysšej škole. Moskva, 1967.

Gal'perin, P., Jazykovoje soznanije i nekotoryje voprosy vzaimootnošenija jazyka i myšlenija. Soveščanije po probleme vzaimootnosjenija jazyka i myšlenija. Moskva, 1977.

Gochlerner, M., Poetapnoje formirovanije grammatičeskich mechanizmov reči na inostrannom (nemeckom) jazyke. In: A.Ždan and M. Gochlerner Psichologičeskije mechanizmy usvojenija grammatiki rodnogo i inostrannogo jazykov. Moskva, 1972.

Gol'din, Z., Metodika obučenija inostrancev russkomu skloneniju. Avtoreferat, Moskva, 1970.

Jakobovits, L., Foreign Language Learning. A Psycho linguistic Analysis of the Issues. Rowley, Mass., 1971.

Kabanova, O., Formirovanije grammatičeskoj struktury vyskazivanija. Avtoreferat, Moskva, 1971.

Kempen, G., De taalgebruiker in de mens (The Human Language User). Groningen (The Netherlands), 1976.

Kučerova, T., Usvojenije vido-vremennoj sistemy anglijskogo glagola po metodike poetapnoj formirovanije umstvennych dekstvija. K probleme upravlenija obučenijem i vospitanijem. Moskva, 1970.

Kuljutkin, Ju.N. & Suchobskaja, G.S., Ob izpol'zovanije schematičeskoj nagladnosti pri formirovanii grammatičeskich umenij. In: Voprosy Psichologii, 1967, no. 1.

Kuljutkin, Ju.N., Evrističeskije methody v strukture rešenij. Moskva, 1970.

Landa, L.N., Algorithmierung im Unterricht. Berlin (DDR), 1969 (Russ. orig. 1966)

Landa, L.N., (ed.) Voprosy algoritmizacii i programmairovanija obuěnija. Vyp. 2. Moskva, 1972.

Landa, L.N., Some Problems in Algo-Heuristic Theory of Thinking, Learning and Instruction. In: Structural Process Models of Complex Human Behavior. J.M. Scandura & Ch.J. Brainerd (eds.), Alphen aan den Rijn (The Netherlands), 1978.

Leont'iev, A., Sprache-Sprechen-Sprechtätigkeit. Kohlhammer Verlag, Stuttgart, 1971 (Russ. orig. 1969).

Markova, A.K., The Teaching and Mastery of Language. In: Soviet Education. Vol. XXI (1978-79) no. 2-3-4.

Parreren, C.F. van, Grammatical Knowledge and Grammatical Skill. In: A. van Essen/J. Menting (eds.) The Context of Foreign-Language Learning. Van Gorcum, Assen (The Netherlands), 1975.

Resnick, L.B., Task Analysis in Instructional Design: Some Cases from Mathematics. In: D. Klahr (ed.), Cognition and Instruction. Hillsdale N.Y., 1976.

Vjatutnev, M., (ed.) Russkij Jazyk 2 Audio-vizual'nij kurs dlja zarubežnich škol. Moskva, 1972.

Vygotsky, L.S., Mind in Society. Harvard University, Cambridge Mass. London, 1978.

Wertsch, J.V., From Social Interaction to Higher Psychological Processes. A Clarification and Application of Vygotsky's Theory. In: Human Development 22 (1979), pp. 1-22.